

FIRE ALARM AND DETECTION SYSTEM DESIGNS AND INSTALLATIONS

UNIVERSITY CONTACT: Bernie Alexander, Fire Protection Engineer, Occupational Health
& Safety
(302) 831- 8475

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This document identifies the minimum design, installation, testing and quality levels for new fire alarm and detection systems being supplied to any University of Delaware facility. The Architect/Engineer shall include all of these minimum requirements within the content of the bidding documents and ensure that all minimum requirements are complied with through completion of the project.

General

1. The intent of the system shall meet the minimum code requirements as specified, but in addition, shall meet the specific level of life safety and protection as required by the University of Delaware in these minimum requirements. In almost all cases, these minimum requirements will require a higher degree of protection and workmanship than that specified by the referenced codes.
2. The system shall be designed in a modular fashion to insure future expansion capability. Furthermore, it shall be the intent of the system to monitor all fire suppression systems,

fire extinguishing systems and building services as designated. The fire alarm and detection system is the centerpiece of the University of Delaware's life safety systems and is intended to provide a high degree of alarm notification, detection, critical system monitoring and selected control outputs. Currently, this design is intended to provide the University of Delaware with a high degree of reliability and NO unwanted alarms.

3. In large and intricate facilities the University would prefer to have a single point addressable system. In smaller less intricate facilities the University will consider a standard zoned fire alarm and detection system. The designer of the system shall consult with the Department of Occupational Health and Safety and the University's liaison representative (University Liaison Representative) to identify the specific type of system being proposed.

Types of signaling systems and method of occupant notification will be determined at the time of consultation with the Department of Occupational Health and Safety and the University Liaison Representative.

4. The design, installation, workmanship, testing and documentation of the system must be of the highest quality. The design team, the Department of Occupational Health and Safety and the University Liaison Representative shall be the final judge of quality issues and their decision is final.

If bidders or any interested parties have a concern with these conditions, they shall note their concerns in writing at the time of pre-bid meetings and at the time of bid submission.

5. The fire alarm system shall be a stand-alone fire alarm system. The building shall be interconnected to the University of Delaware's central alarm receiving station located at the Department of Public Safety, 79 Amstel Ave, Newark, Delaware. The fire alarm design and installation shall include all digital alarm communicators and like equipment to complete the central station service. The designer/contractor shall coordinate phone line service with the University's Telephone Services Group and Department of Public Safety. This contact may be initiated through FP&C or the University Liaison Representative.
6. The fire alarm system shall be complete in all respects for operation and interface with existing building equipment related to or desired to be controlled by the fire alarm system. All work shall be coordinated with the University of Delaware's Department of Facilities Management. The designer shall include in his/her design all work necessary to interface Heating, Ventilation and Air Conditioning shut-down, sprinkler monitoring and control, building systems monitoring, smoke management and other code specified supervisory functions. Any equipment, wiring, installation or other work necessary to

finish all interface and output wiring or equipment shall be included in the design and subsequent bid packages.

References/Required Code Compliance

7. The following is a list but not limited to all required codes and standards used at the University of Delaware for fire alarm installations. All standards listed shall be considered to be the most recent edition published. The designer shall include these standards in his/her design and bid package.
 - A. National Fire Protection Association 72 - National Fire Alarm Code
 - B. National Fire Protection Association 25 - Water-based Fire Protection Systems,
 - C. National Fire Protection Association 101 - Life Safety Code,
 - D. International Building Code
 - E. Underwriters' Laboratories fire alarm and fire alarm equipment listings, approvals and standards.
 - F. National Fire Protection Association 70 - National Electric Code,
 - G. Department of Occupational Health and Safety Minimum Criteria for Fire Alarm and Detection System Designs and Installations.
 - H. Americans with Disabilities Act,
 - I. National Fire Protection Association 90A - Air Condition and Ventilating Systems,
 - J. National Fire Protection Association 92A - Smoke Control Systems,
 - K. Factory Mutual Global Guidelines,
 - L. Others as specified by Design Team
8. All equipment, components, wiring, design and installation of all items as described or implied in this document shall be Underwriters Laboratory listed and approved for the use intended unless otherwise approved by the Department of Occupational Health and Safety.

9. All equipment, components, wiring, design and installation of all items as described or implied in this document shall be reviewed and approved by listed approving authority. The Contractor shall be responsible to submit all design documents and obtain all approvals from each listed code authority and the Department of Occupational Health and Safety.

Document Review Process

A review required for the University of Delaware Projects are as follows:

1. City of Newark Fire Marshal's Office (or other relevant authority having jurisdiction i.e. City of Lewis, DE., State of Delaware Fire Marshal's Office, City of Wilmington Fire Marshal's Office, etc.)
 2. Factory Mutual Global Company
 3. Department of Occupational Health and Safety
 4. University Liaison Representative
10. The designer shall include in the bid package that the Contractor/fire alarm vendor shall be responsible for all submissions costs and the Contractor/fire alarm vendor shall be responsible for obtaining of all required approvals, permits, and acceptance inspections/approvals from all legal and/or required agencies, inspection organizations and insurance groups as listed above.

Project Coordination and System Documentation

11. Designer shall include in his/her bid package for the Contractor to fully coordinate design, equipment, devices, installation, wiring and connection of all fire alarm systems with the designated University Liaison Representative for the specific project throughout each developmental stage of the project.
12. The Contractor shall include in his schedule key times to notify the University Liaison Representative for periodic inspection of the system installation. The University requires an inspection of the installation at the following points of:
 - a. Shop drawing development
 - b. 25% of rough in wiring installation
 - c. Device and panel installation
 - d. Final acceptance testing

13. At the time of plan submission and shop drawings to the Department of Occupational Health and Safety, the Contractor shall provide a narrative description of the fire alarm and detection system proposed design and arrangement. This shall include type and features of the equipment proposed for use. Description should be accompanied by manufacturer cut sheets of each proposed device and control equipment. Included in this submission shall be an item-by-item list of any exceptions, alterations, modifications or changes that are contrary to the specifications, bid drawings, or this document.
14. All shop drawings shall show proposed wiring diagrams point-to-point with labeled terminal and splice points, data sheets, equipment ratings, layout, dimensions, material type and finishes.
15. Submit material list indicating proposed manufacturer's name and design/installation data for all systems and materials listed, specified or intended for use by the Contractor.
16. All shop drawing submissions shall include the following:
 - a. A narrative description of the fire alarm system. The narrative description shall include an exact English description of all signaling arrangements, detection arrangements, output and supervisory functions.
 - b. All panel drawings shall show power and battery calculations for the system. Panel drawings shall show all wiring, ribbon and other cable point connections. Show any field or manufacturer modifications to include dip switch set-up positions, jumpers and snipped components including wire color coding and labeling.
 - c. The system shall have a plan view of each floor and detailed riser diagram.
 - d. Actual wire and conduit runs with anticipated methods of matching backgrounds or concealment of wire and conduit. Conduit placement must be approved by Systems Approach.
 - e. System annunciation descriptors for each alarm, trouble and supervisory output signal. Such descriptors shall be "in plain English" for each alarm, trouble and supervisory output signal. The English annunciation descriptors shall use actual terminology used at the Center to include floor names and point of compass designations uncoded. Contractor shall confirm descriptors with Owner's on-site representative prior to shop drawing submission.

Note: Code numbers, zone numbers or abbreviated text will not be approved without exception. Submission of coded, zoned or abbreviated text will be

rejected at the time of shop drawing submission without cause or comment!

17. Contractor shall submit one (1) actual sample of each type of device intended for installation. If devices differ from area to area, then two actual samples of each type of device labeled for the specific area must be submitted. These items include but are not limited to the following:
 1. Manual Pull Stations
 2. Audio Devices
 3. Visual Devices
 4. Smoke Detectors
 5. Heat Detectors
 6. Duct Detectors
 7. Conduit and Pipe
 8. Wiring
 9. Junction and Back Boxes
 10. Weather Proof Enclosures
 11. Water Tight Junction Boxes
 12. Mounting Plates
 13. Addressable Modules (if not in Monitor control panel).
18. Submit large scale drawing (plan and elevation) showing all architectural and technical features of the following:
 1. Main alarm panel location.
 2. Remote annunciators and graphic annunciators.
19. All system parts and components shall be **NEW**, not rebuilt or reconditioned parts or equipment.
20. As part of the design/bidding package the University wants to include one year's testing, maintenance and inspection of the fire alarm system for the duration of the one year warranty period of the system. The contractor shall submit at the time of system acceptance a schedule of maintenance, testing, and service as prescribed by these specifications and referenced standards, for the first year warranty period, (see National Fire Protection Association 72 for additional requirements). The cost for the first year maintenance and testing shall be included in the base bid price.
21. It is the University's policy for fire alarm systems that the warranty period shall begin only after the University has accepted the acceptance test results, verified completion of punch list items and released final payment. Date of commencement of warranty period shall be no greater than 10 working days after verification of completion of punch list

items.

22. The Contractor shall be required to submit the following series of drawings in 1/8 inch scale as follows:
 1. Shop drawings
 2. Panel drawings - as-built
 3. Exact as-built drawings of installation
 4. Schematics of all auxiliary devices and auxiliary system connections such as Emergency Power Off system, Heating, Ventilation and Air Conditioning, Power Distribution Unit, etc.
23. Contractor shall be responsible to provide all shop, panel, schematic and as-built drawings in an AutoCAD version 12.0 or higher format. Drawings shall be multiple-colored ink on high quality, heavy density white bond plotting paper of a standard size sheet to include the following parameters:
 1. CAD (Computer Aided Drafting) form using an acceptable Computer Aided Drafting system capable of producing the magnetic media in a AutoCAD or an AutoCAD compatible DXF format.
 2. All magnetic media shall be on disk, using one disk per drawing, building, or local stand-alone system.
 3. Computer Aided Drafting system and format shall be of a type that is directly transferable through DXF format.
24. The University shall own all magnetic media and original drawings addressed under this requirement. The University shall have the right to modify, reproduce, distribute and use the magnetic media and original drawings in any fashion or for any use that the University may desire.
25. The Contractor and manufacturer shall retain a copy of all as-built drawings and documentation as discussed in these requirements. The Contractor and manufacturer shall not have the right to use any magnetic media, drawings, documentation or other material describing or relating to the University of Delaware fire alarm system without the express written permission of the University.
26. All drawings shall show building background features in "green" ink with single narrow pen width. Panel drawings shall show panel box and chassis in green.
27. All drawings shall show fire alarm and detection features in "black" ink with varying pen

- widths. Separate pen widths shall demarcate devices, point-to-point wiring, device labels, and notes.
28. All drawings shall show under floor fire alarm and detection features in "red" ink with varying pen widths. Separate pen widths shall demarcate devices, point-to-point wiring, devices labels, and notes.
 29. All drawings shall show wire sizes and other similar information in "blue" ink.
 30. Contractor may use other colors to demarcate other features of information on the drawings, but such colors shall be consistent from drawing to drawing.
 31. Contractor shall match wiring details, including number of wires per initiating and signal circuit, and location and type of end-of-line device to type of supervision specified.
 32. Contractor shall show locations of fire alarm control panel on drawings to ensure adequate space is available for power supply equipment and control cabinets.
 33. Contractor shall ensure drawings and specifications agree with respect to type of cable specified and that cable specified is suitable for the environment of the specific project.
 34. Contractor shall produce and provide electrical schematic diagrams of any electrical connections between the fire alarm system and building equipment. These drawings shall be submitted at the time of shop drawings and as-built drawing submission.
 35. As part of this project and included within the base bid cost, the Contractor shall provide the University with "as-built" drawings for the entire fire alarm system showing all features as described in these specifications in their entirety as an "as-built" condition. This is not shop drawings, this is intended to clearly mean "as-builts".
 36. Along with the as-built drawing submission, the Contractor shall supply two complete sets of Computer Aided Drafting files of all drawings including the panel drawings.
 37. The designer shall included in his design and purchase through the contract from the Contractor a wall mounted cabinet to be located near the Fire Alarm Control Panel which shall contain one set of all system documentation to include as-built drawings, zippered binder, system program software disk and drawing Computer Aided Drafting disk files. The cabinet shall be locked and keyed using the same key as the Fire Alarm Control Panel. The cabinet shall be acceptable to the University and be labeled on the front, "FIRE ALARM SYSTEM DOCUMENTATION", "FOR SERVICE USE ONLY". The University will return one of the three sets of documentation that are required by these requirements back to the Contractor for installation into the cabinet.

Note: It is the intent of this section to ensure that a complete and adequate set of documentation exist on site and available to service technicians, inspectors, and fire department. **No documents or other items will be permitted to be stored inside of any fire alarm control equipment or other enclosure.**

Contractor Qualifications

38. Contractor shall (or contractually be supported by a company) specialize in fire alarm systems and have a minimum of five years of documented experience with the design and installation of the actual system and devices being installed.
39. Contractor shall have (or contractually be supported by a company) on staff and assigned to the project a NICET Level III certified person for fire alarm systems. Such person shall have a minimum of five years of documented experience in the design and installation of National Fire Protection Association compliant local fire alarm systems.
40. The Contractor shall assign the NICET Level III certified person to supervise the preparation of all technical documentation, drawings, installation, testing and acceptance testing as required by these requirements. The NICET Level III certified person shall be present at shop drawing review meetings, design issue meetings and all acceptance testing. All drawings shall include the NICET Level III persons name and license's number. In lieu of a NICET Level III person, the Contractor may substitute an registered licensees professional engineer who is specialized in fire protection, electrical engineering or electronic engineering.
41. Equipment manufacturer shall be a company specializing in National Fire Protection Association 72 fire alarm and detection systems with a minimum of ten years of documented experience.
42. All qualification documentation shall be submitted at the time of shop drawings to the Department of Occupational Health and Safety.

System /Component Details

43. All fire alarm detection systems installed at the University shall have **alarm verification features for all smoke detection**. This may be accomplished at the individual device or control panel.
44. At the time of project review with the Department of Occupational Health and Safety, the Department of Occupational Health and Safety will determine if **environmental compensation** features for smoke detection is necessary. The design team shall verify

this requirement with the Department of Occupational Health and Safety.

45. In the event that the project incorporates automatic suppression and/or extinguishing systems, the Department of Occupational Health and Safety will make the decision whether or not to require the primary fire panel to be Underwriters Laboratory listed as a releasing panel suitable for operation and control of and proposed suppression or extinguishing system. Additional releasing panels shall be incorporated into the design unless approved by the Department of Occupational Health and Safety.
46. All fire alarm equipment in the project shall be provided with primary AC power obtained a building electrical subpanel which provides emergency power, if emergency power is provided to the facility. The DC secondary power supply shall consist of a standard fire alarm battery secondary supply as specified in this document and National Fire Protection Association 72.
47. Surge Protector. (AC transient suppressor, AC power. All AC power supplies to any fire alarm panel or components shall be provided with separate surge protection as follows:
 - a. Suitable for protection of electronic equipment and electrical systems 600 volts and less. Device shall be capable of protection of all AC electrical circuits and equipment from the effects of lightning inducted voltages, external switching transients, and internally generated switching transients resulting from inductive and/or captive load switching.
 - b. Surge suppressions shall meet:
 1. National Fire Protection Association 70.
 2. Underwriters Laboratory #1449 Standard for Fire and Safety-TVSS/SPD.
 3. IEEE Std. 142-Recommended Practice for Grounding Std. 518-Recommended Guide on Electrical Noise ANSI/IEEE, C62.41-1991 Edition. Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
 4. Federal Information processing Standards Publication 94 (FIPS PUB 94).
 - c. Acceptable Manufacturers:
 1. Transtector Systems, Inc.
10701 Airport Drive
Hayden Lake, ID 83835
Tel: 1-800-882-9110
FAX: 208-762-6133

- d. Service Protection Panel enclosure shall be a minimum of a (NEMA 4) construction, factory primed and field painted to match mounting surface.
 - e. The Service Protection Panel system as required shall consist of a Service Protection Panel for each service rated 600 volts or less, and/or Branch Panel Protectors. All devices shall operate as a total coordinated and engineered system, as well as be engineered as a system by the manufacturer.
 - f. Maximum continuous operating voltages of any system component shall not be less than 115% of the nominal system operating voltage.
 - g. All Service Protection Panel components shall be rated with an operating temperature range of 30 to 120 degrees Fahrenheit, and from 0 to 85% humidity noncondensing.
 - h. Nominal system frequently is 60 Hertz, operating frequency range of the Service Protection Panel system shall be 0 to 400 Hertz.
 - I. All Service Protection Panels shall be connected in parallel with the power system they are protecting. Series connected components shall not be used. Suppression paths shall not be grounded.
 - J. All Service Protection Panels shall be Underwriters Laboratory 1449 listed and bear the Underwriters Laboratory label.
48. When a remote annunciator is proposed for the facility, the contractor shall provide a supervised LCD remote annunciator including audible and visual indication of fire alarm by zone, and audible and visual indication of system trouble. Install in flush, wall-mounted enclosure. All remote annunciators shall provide the same English descriptor as other required annunciation from printers, CRTs and fire alarm panel annunciators. Annunciation shall be remote LCD annunciators which shall indicate alarm, trouble and supervisory conditions by individual English descriptors. The remote LCD annunciator shall also be provided with a keyed switch or access code to perform system acknowledgment and system reset.
49. Duct Mounted Smoke Detectors shall be photoelectric type with auxiliary SPDT relay contact, key-operated NORMAL-RESET-TEST switch, duct sampling tubes extending width of duct, and visual indication of detector actuation, in duct-mounted housing. Duct detectors must be provided with remote annunciation lamp at key switch in approve locations.

Remote annunciation lamp must be located in normal occupied area at the approval of the

Department of Occupational Health and Safety. Duct Mounted Smoke Detectors must be securely mounted "without possibility of vibration" and located for accessibility and ease of maintenance/testing. Duct detector shall be provided with a remote test switch: Key-operated switch mounted may be on flush cover with lamp to indicate detector actuation. (Provide one switch for each duct mounted smoke detector). All flex connections from and to duct detector and fan/damper control equipment shall be installed in Sealtight.

50. Upon consultation with the Department of Occupational Health and Safety, University Liaison Representative and the design team, the fire alarm system shall include an exterior alarm light and horn. The alarm light shall be a 360° revolving red light, weather tight, seal beams and approved for use in exterior locations. Each exterior light shall be combined with an exterior audio horn in a weather tight and approved enclosure for exterior use. The alarm light can be powered by ordinary building AC power and need not be provided with a secondary power supply.
51. Fire Alarm Power and Branch Circuits shall be wired in accordance with National Fire Protection Association 72 and National Fire Protection Association 70, Section 760. Each power source shall be obtained from an emergency power circuit and the breaker shall be marked "FIRE ALARM POWER SOURCE" and be provided with a "red" locking device so as to prevent accidental power loss. Contractor shall be responsible to run all power from the closest emergency circuit panel to the fire alarm system.
52. Initiating and Signal Circuits including any and all nonpower limited fire-protective signaling cable, **solid only** copper conductor, 150 volt insulation rated 60 degrees C. Any and all power limited fire protective signaling cable, copper conductor, 300 volts insulation rated 105 degrees C. Power limited fire protective signaling cable classified for fire and smoke characteristics, **solid only** copper conductor, 300 volts insulation rated 105 degrees C, suitable for use in air handling ducts, hollow spaces used as ducts and plenums.
53. Any fire alarm cable which is not required in conduit and is located in a supply or return air plenum space must be a type of cable and insulation which is approved by Underwriters Laboratory for air plenums regardless of whether a plenum exists.
54. All fire alarm cabling and devices which are installed within 10 feet of water equipment and sprinkler equipment shall be installed in Sealtight conduit with liquid tight connections and liquid tight (waterproof) boxes. All seal tight shall be connected so as to tolerate a minimum pull force of 50 lb. without separating from the connected device.
55. Use 14 AWG minimum size twisted/shielded conductors for fire alarm signal circuit conductors. All communication bus cable shall be 18 AWG twisted/shielded solid copper

wiring using fire alarm listed plenum cable in all exposed areas. Any area subject to moisture or the effects of weather shall use water resistant conduit, enclosures, fittings, adapters and like equipment.

56. All fire alarm and device installation which is installed under raised floors or within 10 feet of a water or cooling system, or on exterior or unconditioned spaces shall be installed in Seal Tight flexible conduit and water tight connections, back boxes and junction boxes.
57. All devices, boxes and conduit shall be installed plumb and level.
58. Mount end-of-line device in box with last device or separate box adjacent to last device in circuit. Each end-of-line device box shall be labeled "EOL" and be visible from front of device. If "EOL" is mounted in separate junction box, the face of the box shall be labeled.
59. Mount outlet box for electric magnetic door hold open and release devices to withstand 80 pounds of pulling force.
60. All wiring connections to sprinkler flow switches, sprinkler valve tamper switches, fire extinguishing systems, duct detectors and building interface equipment using conduit to within ten feet of device wherein the conduit shall terminate at a junction box. From the junction box to the device, the fire alarm wire shall be run in an approved Sealtight conduit and secured at each connection point to withstand a 50 lb. pull force.
61. All detectors and other alarm devices shall be securely mounted with approved back box. If visible, back box shall either match color of the device or match color of wall surface if surface mounted. Only approved and appropriate type of conduit and/or wire connectors shall be used for connection to back boxes or devices.
62. All smoke detectors and alarm monitor or control devices which are installed under a raised floor shall be provide with an approved drip shield to shield the device from water that could drip from above or on top of the raised floor surface. The design and installation method shall be proposed by the contractor and shall be subject to the approval of the Department of Occupational Health and Safety at the time of shop drawings.
63. All connections to devices, boxes, back boxes alike devices including any wiring exiting properly terminated conduit, junction box, Sealtight or Greenfield shall be provided with strain relief sufficient to secure cable at the point of entry or exit. Any entry or exit from a device, conduit, Sealtight or Greenfield shall be through an appropriate and approved box which is designed and installed to prevent chafing, cutting or other damage to the

cable.

64. All conduit that is installed within areas subject to moisture, rain or drainage shall be installed using approved water resistant and watertight conduit, enclosures and like equipment.
65. All system devices, panel and junction boxes shall have a unique identifier number which shall be:
 1. Labeled on each device, panel and junction box with durable label capable of surviving environmental conditions.
 2. Labeled on all drawings.
 3. Labeled on all parts lists and required testing documentation.
 4. The unique identifier numbering system shall be approved by the Department of Occupational Health and Safety at the time of shop drawing submittal.

Note: The intent of this requirement is to have each and every device and component (except panel components) have a logical and unique number whereby all inventory, documentation and life effort can be tracked by the unique number.

66. Each conductor (individual wire) shall receive a unique and durable wire number at each terminal block, splice connection, device terminal and any other location where a conductor is landed. Each wire number shall be shown on as-built drawings or a separate document shall be produced in final documentation which describes the wiring to each devices. In all areas where the atmosphere is unconditioned, the wire number shall be protected with a clear heat shrink protector sleeve or similar method approved by the Department of Occupational Health and Safety.
67. Digital Alarm Communicators shall be installed in a separate enclosure adjacent to the main fire control panel and shall not be installed inside of the main fire control panel. The enclosure shall be labeled "Digital Alarm Communicator" and marked with its unique identifier number. The enclosure shall be of sufficient size to contain all components parts of the Digital Alarm Communicators system to include the communicator, secondary power supply, phone jacks and like equipment. All wire connections between Digital Alarm Communicators system and the fire alarm control panel shall be in conduit.

Acceptable Manufacturer: Digital Monitoring Products – Model L-XR5SL

68. Power supply side surge suppression device(s) shall be installed in a separate enclosure adjacent to each fire control panel but shall not be installed inside of the fire control panel. The enclosure shall be labeled "Power Supply Surge Suppression" and marked with its unique identifier number. The enclosure shall be of sufficient size to contain all components parts of the surge suppression system to include terminal strips. All wire connections between the surge suppression system and the fire alarm control panel shall be in conduit. It is the intent of this specification to require additional and redundant surge protection for all system components where they receive external AC or DC power.
69. Contractor shall be responsible to install all system components, wiring and conduit in a workmanship like manner and to the satisfaction of the Department of Occupational Health and Safety and the University Liaison Representative. The Department of Occupational Health and Safety and the University Liaison Representative shall determine acceptable level of workmanship. Examples of existing installations or other contractor installations shall not be used for evaluation of acceptable workmanship under the fire alarm contract work. Only the highest quality workmanship will be accepted. **There are no exceptions to this requirement.** Simply said, just because you see another system installed with less than the highest quality of workmanship, doesn't mean it will be acceptable for the fire alarm system.
70. Contractor shall provide fire alarm circuit conductors with color coded insulation, or use color tape at each conductor termination and in each junction box. Color code shall be specified by the Contractor at the time of shop drawings and shall be consistent through all fire alarm systems. Color code shall be listed on all shop and as-built documentation/drawings.

Alarm activation Sequence

71. Sequence of Operation. As a basic operation of the system the designer shall include at a minimum the following sequence of operations:

Upon any fire alarm:

- a. All audio and visual alarms to sound throughout the building or fire area as applicable and said fire area shall be identified and approved by the Department of Occupational Health and Safety.
- b. Annunciate specific device or zone in common plain English at the Fire Alarm Control Panel, printer and remote annunciators in plain English description. Annunciation descriptors shall be the standard terminology used by the University for the specific building and for each area within the building. Descriptors shall not be abbreviated. All terminology and

descriptors shall be approved by the University Liaison Representative at the time of shop drawings.

- c. Cause transmission of an alarm signal to the University's central station service.
- d. Deactivate electro-magnetic door hold open devices.
- e. Output fan shut-down if affected air handler is involved.
- f. Activate other outputs as required by design.

Note: A general alarm device signal is any device signal that is not identified as a special or supervisory device signal.

Special systems may require a special operation sequence. Each special system shall be reviewed by the Department of Occupational Health and Safety and approved.

Upon activation of any supervisory or trouble alarm shall cause the following:

- a. Annunciate specific device or zone in common plain English at Fire Alarm Control Panel, printer and remote annunciators in plain English description. Annunciation descriptors shall be the standard terminology used by the University for each area. Descriptors shall not be abbreviated. All terminology and descriptors shall be approved by the University Liaison Representative at the time of shop drawings.
- b. Cause transmission of the supervisory alarm signal to the University of Delaware's central station service .

72. Spare Parts. Contractor shall include in the base bid the cost to provide all manufacturer's recommended spare parts and devices. At a minimum, the Contractor shall provide at the final acceptance test the following spare parts and devices:

- a. Two smoke detectors of each type used on the project.
- b. One heat detector of each type used on the project.
- c. One manual pull stations of each type.
- d. Two of each type of fuse used in each fire alarm system.

- e. Two audio devices of each type used on the project.
 - f. Two visual devices of each type used on the project.
 - g. Two replacement lamps of each type used on the project.
73. All spare parts shall be listed on all inventory lists and each spare part shall be labeled for the specific system or component it is intended.
74. All secondary power supplies (batteries) shall be calculated in accordance with manufacturer's recommendations and include design spare capacity. Battery size shall be increased by 15% above minimum calculation.

Special Conditions

75. Contractor shall conceal all conduit and wiring above ceilings where possible. The decision to allow exposed conduit shall be the design team's and shall be made at the time of shop drawings. Any exposed conduit or wiring shall be clearly and blatantly annunciated by the Contractor through the use of color code or other annunciation method on the shop drawings so that it cannot be easily missed during review.
76. Termination's, splice connections and all other connections shall be made by the use of Underwriters Laboratory listed compression terminal strips as approved by Systems Approach. **No wire nuts or crimp connection devices will be approved.**
77. All end-of-line resistors shall be landed on terminal strips mounted into back boxes or other appropriate electrical enclosures. All end-of-line device leads shall be insulated from short conditions by use of standard wire insulation material or approved heat treated wire insulation. No electrical tape will be permitted.
78. Installation of each system component and its associated equipment and wiring shall be in strict accordance with manufacturer's recommendations and instructions.
79. Provide and tag conductors at all junction and terminal points and identify by same number on all shop drawings.
80. All conduit, cable, outlet and mounting boxes required as part of mounting arrangements shall be color-coded red if not in public area.
81. Protect exposed wiring above hung ceiling construction from physical damage where necessary by conduit, guard strips or other approved means. Install all drops to wall devices in conduit or Greenfield unless fished. Properly support low voltage cables and

conduit from structure by the use of **Bridle Rings**. At those points where the wire descends below steel structure, the wire must be provided with adequate strain relief which is designed not to cut or ground cable shields (no wire ties). The wire shall descend plumb to the device or transition. Secure cable in place at intervals not exceeding 4-1/2 feet and within 12 inches from every cabinet, box or device. Cable stress relief shall be required for all connections to devices and boxes.

82. Provide all fire alarm wiring in separate raceways.
83. Be responsible for assuring that conduit size and wire quantity, size and type are suitable for the equipment and conditions as they exist. Review the proper installation of each type of device with the equipment supplier. Make final connections between the wiring and equipment under the supervision of equipment manufacturer's certified technician and NICET person in charge.
84. Be responsible to seal all floor and wall penetrations with approved materials which will provide the equivalent fire resistive rating as that of the wall, floor or ceiling that was penetrated. Contractor shall also be responsible to reseal or repair any access ways or penetrations made through draft stops or fire stops with materials and workmanship which equals the original intended fire rating of the draft stop.
85. Each and every alarm initiating device, supervisory device, monitoring device, control panel and junction box shall be provided with a unique number which shall be intended to specifically identify that item uniquely within its parent system. The unique number shall be clearly marked on the face of the device so as to be visible from 10 feet from a normal visual position.
86. The unique number shall be an identifier within a logical system and numbers shall be assigned in a logical and systematic order.
87. The unique number shall be shown on all shop drawings and other documentation that annunciates, describes or documents said item. This would include inventory listing, materials lists and manuals submitted under Part 5 - Requirements.
88. All conduit, devices and other system components that are installed in areas subject to unconditioned atmospheres, moisture, watering, rain or drainage shall be installed using approved water resistant and water tight conduit, enclosures and like equipment.
89. Installation of each system component and its associated equipment and wiring shall be in strict accordance with manufacturer's recommendations and instructions.
90. Provide power supply wiring to system components from building electrical panel

emergency circuits. The primary power supply shall be taken from an existing emergency circuit that is supplemented by the building's emergency generator. Circuit breaker shall be sized in accordance with system demand and the Not Elect Code. Branch circuit breaker shall be clearly labeled for fire alarm service, contiguous to the circuit breaker toggle switch and the toggle switch shall be provided with a lock to prevent accidental movement.

91. Provide all low voltage signal wiring for systems specified herein in a workmanlike manner. Provide system raceways in accordance with manufacturer's requirements for installation of system's wiring. Provide and tag conductors at all junction and terminal points and identify by same number on all shop drawings. All conduit, cable, outlet and mounting boxes required as part of mounting arrangements shall be color-coded red if not in public area.
92. Provide all wiring within air handling plenum areas in conduit, and extend three feet beyond and outside of plenum.
93. All devices shall be provided with an approved back box. If back box is exposed, it shall be subject to the same painting requirements as conduit and other devices.
94. All wiring for a system shall be in accordance with Articles 725, 760 and 800 of the Nat Elect Code and local electrical codes and authorities having jurisdiction.
95. The unique number shall be shown on all shop drawings and other documentation that annunciates, describes or documents said item. This would include inventory listing, materials lists and manuals.
96. Any panel or device needing any type of key (standard, hex, etc.) to open or reset any panel or device must be keyed to the fire alarm system keys of Public Safety field master keys.

Software and Programming

97. Copies and adequate, explanatory documentation of all software and programming used in any fire alarm system shall be provided to the University at time of acceptance testing approval.

98. The University shall own all software and programming both hard copy listing and magnetic media that is part of the operational, updating, renovation and maintenance need of the system. Software in a hard copy listing and magnetic media acceptable to the compatibility of the equipment supplied by the Contractor.
99. If it is a condition of the Contractor or Manufacturer to require licensing of any software or programming, the Contractor and/or Manufacturer shall provide such licensing to the Owner as part of this project. Cost of such licensing shall be part of the base bid package.
100. The University shall have the right to modify, use or reproduce for his own use, any software or programming which is part of this project.

ACCEPTANCE, TESTING, AND DOCUMENTATION

101. All fire alarm systems, component parts, and supervisory functions shall be subject to an acceptance test to be conducted by the Contractor but at the direction of the University Liaison Representative. The system shall be completely operational, finished and ready for acceptance testing in accordance with anticipated project schedule.
102. The Department of Occupational Health and Safety shall be notified 15 working days prior to acceptance test with the specific date, time and system being tested.
103. All approvals (with the exception of the acceptance test approval) required by these specifications shall be completed and submitted with the notification of acceptance test date. This includes the following groups: Authority Having Jurisdiction, Department of Occupational Health and Safety, UDT and USFME.
104. Prior to acceptance test submit manufacturer's descriptive literature of actual equipment installed and the following:
 1. Equipment installation manual.
 2. Equipment and device operating instructions manual.
 3. Equipment maintenance and programming manuals.
 4. Equipment/system service and repair data manual.
 5. Parts lists.
 6. Spare equipment and inventory list.
 7. Testing and maintenance schedule as per requirements of this document.
105. All as-built completed drawings required by these specifications shall be completed and submitted with the notification of acceptance test date.

SUBMITTALS- Special attention must be paid to the required submittals listed in items 106,107 and 108.

106. All Contractor field testing and manufacturer testing documentation as required by these specifications shall be submitted with the notification of acceptance test date.
107. Contractor shall provide the Department of Occupational Health and Safety with three complete manuals of "the specific" fire alarm system being tested. The manuals shall document all components of the system identified by unique number, consistent with the shop drawings and "as-built" drawings.
108. Contractor shall provide all documentation, testing and inspection items identified under these requirements in bounded and labeled three-ring binders with zippered ends. Each binder shall be labeled on the cover indicating the fire alarm system and building being documented.
109. Each section of the notebook or volumes shall be arranged with section tags and documentation as follows:
 - a. Project cover sheet listing project name, owner, contractor, vendor, and consultant.
 - b. Manual index.
 - c. Service Directory.
 - d. Fire Alarm Approvals. Include:
 1. Copy of Fire Marshal Application for fire protection plan review, completed and marked paid.
 2. Copy of Fire Marshal's Office plan approval form.
 3. Copy of Fire Alarm Signaling Systems Company License.
 4. Copy of NICET Certification, certificate of technician.
 5. Original of National Fire Protection Association 72 Fire Alarm System Certification and Description.
 6. Copy of Fire Marshal's System Inspection and Final Approval Form.

- e. Narrative of system description and operation.
 - f. System installation and service manual. (Note that these are two separate documents.)
 - g. Equipment inventory list, with unique identifier labels for each device. Include equipment data sheets.
 - h. Parts list of all components, modules, devices, wiring harness, and cross referenced with unique identifier number/label.
 - i. Divider section labeled "Punch List Items".
 - j. Manufacturer/vendor system testing. This section shall contain all installation, check-out and acceptance testing data as per these specifications.
 - k. First year warranty and test schedule.
 - l. Wire list.
 - m. Alarm and Supervisory Zone Listing. As worded on actual plain English descriptors.
 - n. As-built drawings. To be installed in protective clear plastic sleeves. One drawing per sleeve.
110. At the conclusion of all testing, the Contractor shall document each part or test result from the acceptance test in a form suitable for installation into the required three ring zippered binder. It is recommended that the test data collected in the acceptance be performed and documented during Contractor's system check-out and documented in binder prior to delivery to the Department of Occupational Health and Safety. If this recommendation is accepted, acceptance test will be performed much faster and any delays in release of final payment will be avoided.
111. University acceptance of system shall not be completed until all faults, malfunctions and documentation as required by these specifications have been completed, delivered and verified by the University Liaison Representative or the Department of Occupational Health and Safety.
112. The fire alarm system shall be tested in accordance with the guidelines set forth in these specifications and National Fire Protection Association 72. All testing shall be

documented in report form to the University Liaison Representative in accordance with these requirements. Documentation and testing shall consist of each item noted in National Fire Protection Association 72 and the following:

- a. Stray voltages between circuit conductors and ground. Verify compliance on as-builts.
 - b. Ground faults on all conductors other than those intentionally and permanently grounded should be tested for isolation from grounding using an isolation testing devices such as a "megger". Documentation of "megger" testing shall identify each conductor in note form on as-builts or in ledger form identifying tested conductor and test results.
 - c. Short circuits on all conductors other than those intentionally and permanently connected together for conductor-to-conductor isolation. To be verified on as-builts.
 - d. Measure and record on as-builts loop resistance with each circuit pair short-circuited at the far end of the circuit with an ohmmeter and record the resistance on each circuit as shown on the as-builts.
113. Manufacturer's representative check. Prior to placing power to the system, a Manufacturer's representative check-out shall be conducted and verified in writing to the University Liaison Representative. The report shall contain the following, but shall not be limited to:
- a. A complete list of equipment installed and wired.
 - b. Indicate that all equipment is properly installed and conforms to the manufacturer's and these specifications.
 - c. Test individual devices in accordance with National Fire Protection Association 72 acceptance test criteria.
 - d. Technician's name, manufacturer certification, and date.
 - e. Test of individual inputs and outputs for intended function and supervision.
 - f. Test to verify the functional operation of the central monitoring point and remote annunciators individually and as a complete system under the following conditions:

1. Normal operational condition
 2. Alarm condition
 3. Under primary power failure
 - g. Test and demonstrate proper coordinated interfaces with Heating, Ventilation and Air Conditioning, suppression and extinguishing systems and any other interfaced system or device, under the following conditions:
 1. Normal operational condition
 2. Alarm condition
 3. Under primary power failure
 4. Output function features
 - h. Measure, adjust, and record each smoke detector (including duct smoke detection and beam detection), to its medium sensitivity setting. This must be performed at the operational location of the unit and under normal environmental conditions. The sensitivities shall be recorded with serial number, location number and model number for each detector. Confirm that smoke detectors are within their Underwriters Laboratory listed sensitivity production window. All sensitivity testing shall be recorded in the documentation or as-builts. All sensitivity recordation shall be in "percent per lineal foot light obscuration", not voltage, using an approved smoke detector sensitivity testing apparatus as listed by the manufacturer.
 - i. Confirm and document that all alarm point annunciation descriptors are correct, in compliance with shop drawings, presented in plain unabbreviated English, and are annunciated to all remote annunciators and printer as required by these specifications.
114. Upon completion of fire alarm testing, the Contractor and respective Manufacturer's authorized field engineer shall conduct functional and instructional tests for the University Liaison Representative.
115. Acceptance testing shall be specified by the contractor. The Contractor shall develop an outline for approval by the University Liaison Representative, but at a minimum, the testing shall be as follows:
- a. Confirm all documentation has been received:

As-builts - check accuracy
plan views

riser diagram
panel drawings
battery calculations

DXF disk labeled

Manual - check content
system descriptions
parts list
spare parts inventory
device cut sheets s installed
schedule for first year's maintenance and testing
testing documentation of devices and system

- b. Inspect panel for installation, power, etc.
- c. General walk-down of devices to identify any missing device or obvious problems.
- d. Test bell/strobe circuits for audio level with db measurements.
- e. Test of battery back up.
 - o full load test for five minutes
 - o test and record voltage during full load test
 - o test and record amps during full load test
 - o test and record recharge amp rating
 - o test and record battery draw during normally standby mode in amps
 - o test and record battery recharge voltage no load = vac
 - o test and record battery recharge voltage with load = vac
- f. Test of primary power.
 - o voltage=vac/vdc
 - o circuit breaker tagged and locked open
 - o surge protection under full load after system has been operating on secondary power for 24 hours
- g. Bell circuit amp loads.
 - o circuit #1 = amps
 - o circuit #2 = amps

- o etc.
 - h. Inspect panel boards for faults.
 - i. Check spare capacity of system.
 - j. Check supervision of all circuits, signal and detection.
 - k. A random sample test of detection and pull station devices for function, supervision and proper installation.
 - l. Confirm English descriptors and labels for zones.
 - m. A random inspection of junction boxes, terminal/splice point boxes, conduit, wiring and general installation features. Looking for workmanship and specification issues.
 - n. Copies of hard and magnetic media of software.
 - o. Additional test as required by individual system design or arrangement to include Halon sequence testing for Halon control in computer room and tape storage vault. This testing to be done without gas discharge.
- 116. The Contractor shall be responsible to conduct all acceptance testing with the Contractor's calibrated equipment, in the presence of the University Liaison Representative. The Contractor shall submit at the time of acceptance test notification and outline similar to the one listed in Item 90.
- 117. At the conclusion, the Contractor shall document each part or test result from the acceptance test in a form suitable for installation into the required three-ring zippered binder.

Owner Instruction/Training

- 118. Contractor or Manufacturer shall provide the University Liaison Representative, maintenance and University Police Force with a minimum of four hours of formal instruction on the operation, maintenance, service and testing of the fire alarm system, devices and related building interfaces. The instruction shall be scheduled after acceptance testing but prior to final payment.
- 119. Contractor and/or Manufacturer shall provide to the University Liaison Representative an instructional outline for each class with all visual aids. All classes shall be structured consistently with traditional educational standards with performance objectives and

testing for all participants. Each student shall receive an instructional certificate indicating number of hours of instruction and satisfactory completion of the course.

Areas of Responsibilities
APPENDIX a

**This appendix lists important specific items which should be referred to by the
Consultant/Designing engineer, contractor and owner.**

Consultant/Design Engineer-Items 6,10,11 and 71

Contractor-Items 9,12,17,20,23,25,35,36,40,67,69,70,75,98,105,106,107,109,113,115 and 117
Owner-Items 97,114 and 115

UNIVERSITY OF DELAWARE-FACILITIES DESIGN STANDARDS
PART VII - OCCUPATIONAL HEALTH AND SAFETY

CSI SECTION: 16720

UNIVERSITY OF DELAWARE FIRE ALARM SYSTEMS MATRIX

	ASSEMBLY CLASS C	ASSEMBLY CLASS B	ASSEMBLY CLASS A	DORMITORY >12 ROOMS	DORMITORY <13 ROOMS	BUSINESS SMALL	BUSINESS LARGE	STORAGE	EDUCA- TIONAL	MERCAN- TILE	INDUS- TRIAL
ALARM VERIFICATION	NO	YES	YES	YES	YES	YES	YES	NO	YES	YES	NO
ENVIRONMENTAL COMPENSATION	NO	YES	YES	YES	NO	NO	YES	NO	YES	NO	NO
PYROTRONICS MXL		X	X	X			X		X		
PYROTRONICS MXLV		X	X						X	X	X
PYROTRONICS MXL IQ	X				X	X		X	X	X	X
PYROTRONICS 8-32 CONVENTIONAL	X				X	X		X		X	X
PYROTRONICS SXL	X				X	X		X		X	X
NOTIFIER AM2020		X	X	X			X		X		
NOTIFIER AFP400		X	X	X			X		X	X	X
NOTIFIER AFP 200	X				X	X		X		X	X
NOTIFIER SYSTEM 5000	X	X	X	X			X		X	X	X
NOTIFIER SYSTEM 500	X				X	X		X		X	X
NOTIFIER SFP 400B	X					X		X		X	X
SIMPLEX 4120		X	X	X			X		X		
SIMPLEX 4100		X	X	X			X		X	X	
SIMPLEX 4020	X				X	X		X		X	X
SIMPLEX 4002	X				X	X		X		X	X
SIMPLEX 4004	X				X	X		X		X	X

UNIVERSITY OF DELAWARE-FACILITIES DESIGN STANDARDS
PART VII - OCCUPATIONAL HEALTH AND SAFETY

CSI SECTION: 16720

SIMPLEX 4005	X				X	X	X	X		X	X
FCI 7200A		X	X	X			X		X	X	
FCI FC7200		X	X	X			X		X	X	
FCI MINI7200A	X				X	X		X		X	X
FCI FC72	X				X	X		X		X	X
FCI CLP	X				X	X		X		X	X